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(54) A machine tool chuck

(57) A machine tool chuck comprises a cylindrical scroll plate 1 with a scroll groove in the face thereof and three radial slots 2 at equi-angular intervals, slider blocks 5 radially movable in the radial slots and each provided with arcuate grooves 4 forming part of the scroll groove, and on the radially inner end with an engaging element 7, a cup-shaped housing 9 in which the scroll plate is rotatable and which is provided at equi-angular intervals with three radial slots 11 receiving three radially movable jaws 13, each provided at the back with arcuate projections 15 in mesh with the scroll groove, and an operating member 17 axially movable in an axial bore 16 in the scroll plate and adapted to be moved by actuating means 32, the operating member being formed with three engaging means 18 adapted to co-operate with the engaging elements 7 so as to move the slider blocks 5 and hence the jaws 13 radially when it is actuated.

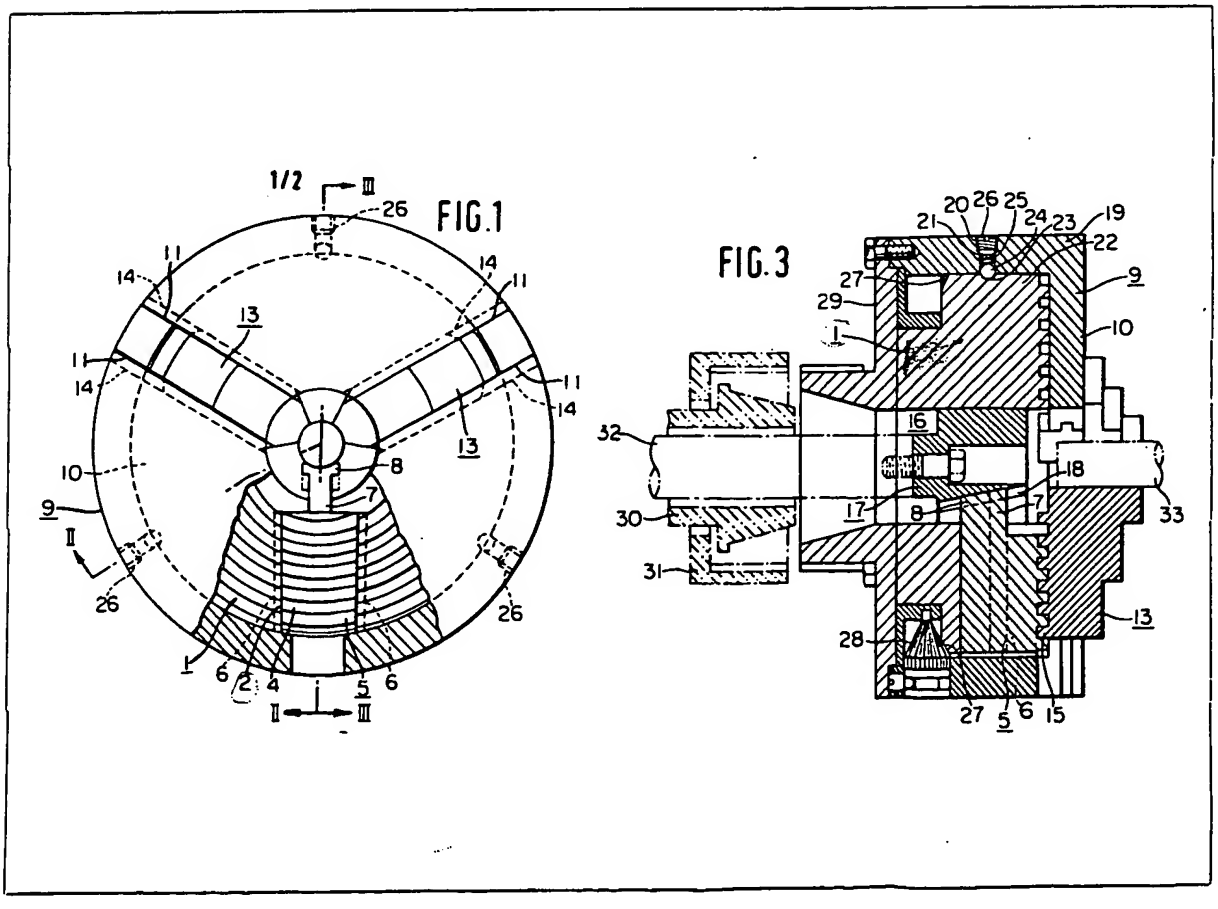

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FIG.1

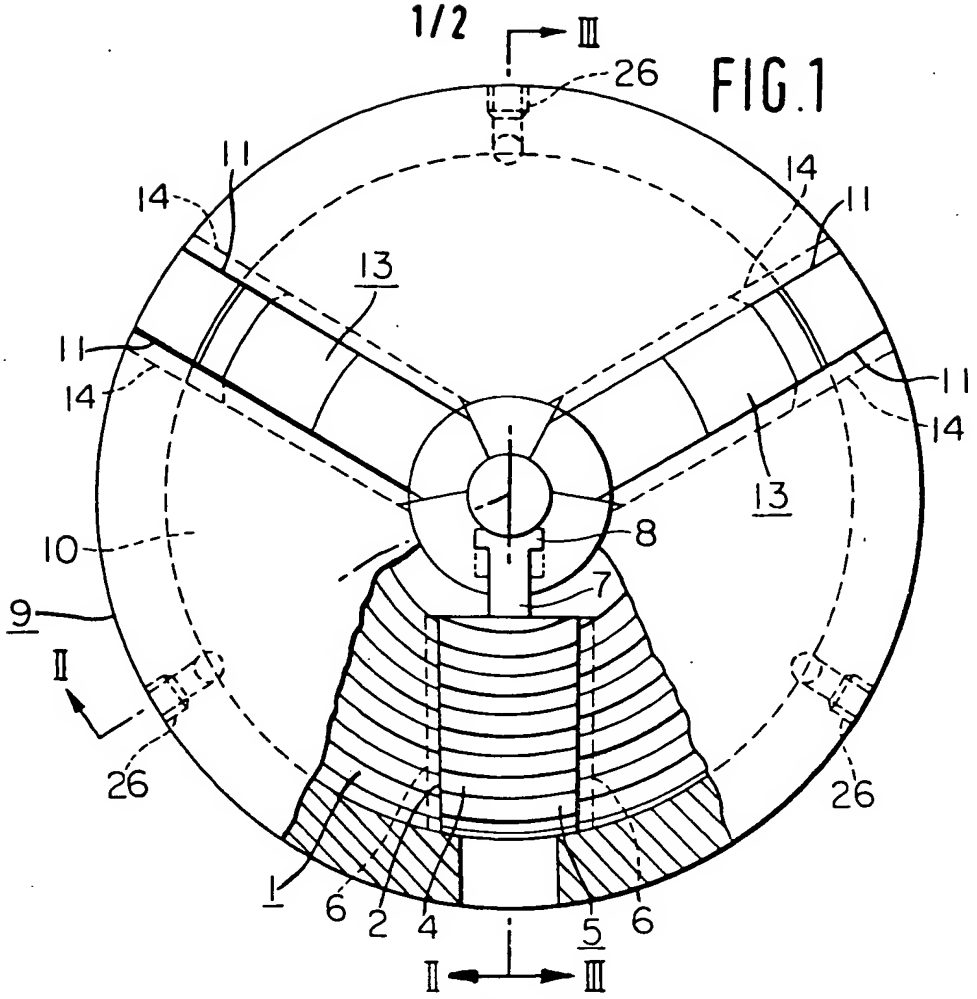


FIG.2

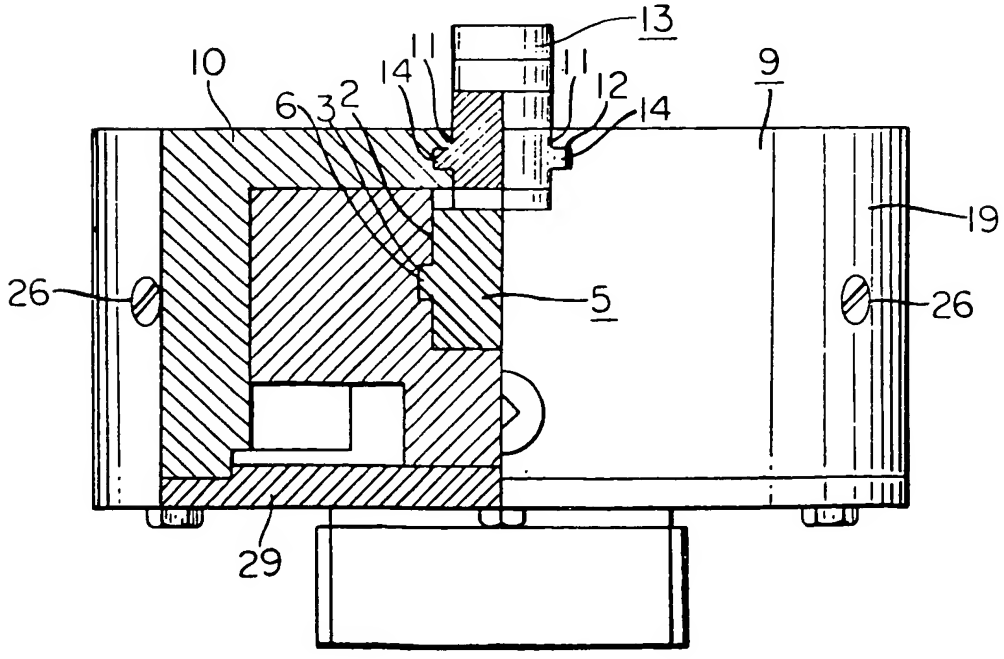


FIG.3

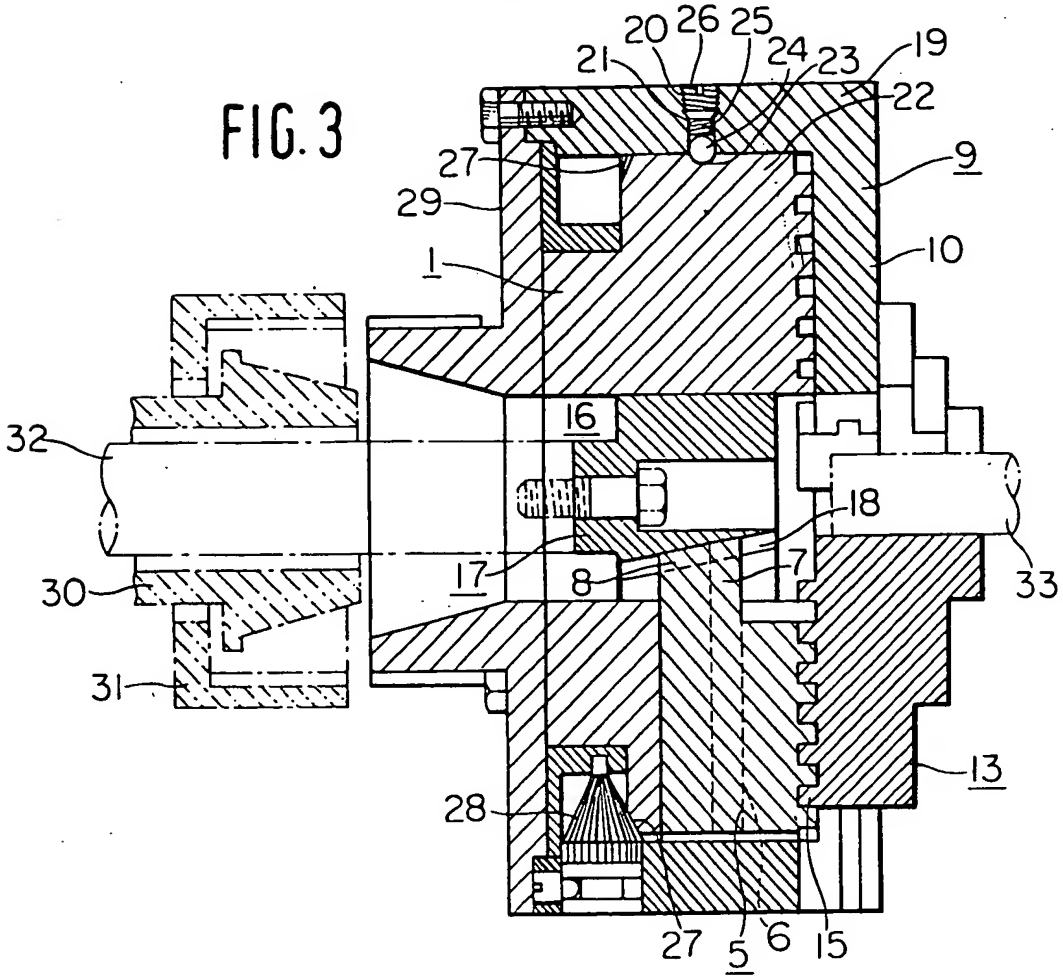


FIG.5

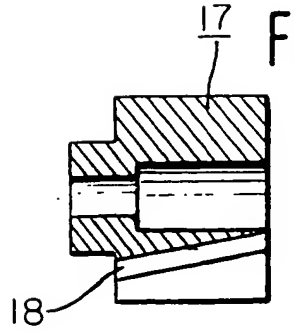
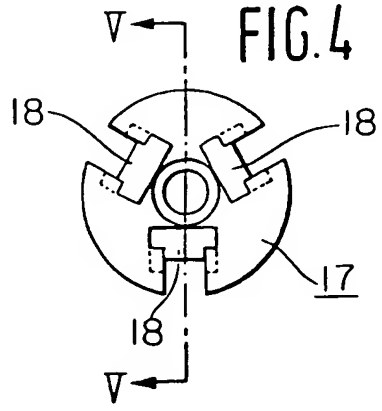


FIG.4



SPECIFICATION

A machine tool chuck

This invention relates to chucks for machine tools, such as a lathe, and more particularly to scroll chucks.

Known scroll chucks have defects such that the force of the chuck jaws to clamp a workpiece is weak and the jaw-actuating components are subject to wear, making centering of the workpiece difficult.

To overcome such defects hydraulic chucks have been used but they have another defect because, each time the diameter of a workpiece changes, the jaws have to be shifted, by loosening the bolts fastening them to the main body, in order to adapt them to the changed diameter, taking a long time to rechuck a workpiece.

It is an object of the present invention to provide a machine tool chuck which can avoid defects inherent in conventional scroll and hydraulic chucks as described above.

It is another object of the present invention to provide a machine tool chuck which incorporates advantages of both conventional scroll chucks and hydraulic chucks.

It is a further object of the present invention to provide a machine tool chuck which allows rapid and sure clamping of workpieces of different diameters.

According to the invention, a machine tool chuck comprises a rotatable scroll plate and jaws, having projections engaged with the scroll, radially movable inwardly or outwardly by rotation of the scroll plate, the jaws being slidable in radial slots in a cover plate having releasable means to enable the scroll plate to rotate or be secured against rotation relatively to the cover plate, the scroll plate having parts of its scroll formed on radial sliders interengaged through co-acting sloping surfaces with an axially movable operating member so that, with the scroll plate held against relative rotation and the jaw projections engaged with the radial slider parts of the scroll, axial movement of the operating member causes radial movement of the sliders and of the jaws engaged therewith.

More particularly the invention provides a machine tool chuck comprising a scroll plate having a cylindrical body with a co-axial bore and a scroll groove in a front face of the body, the cylindrical body having radial slots open to the front face thereof, a corresponding number of slider blocks each radially movable in one of said radial slots and having arcuate grooves forming parts of the scroll groove of the scroll plate, each slider block being provided on its radially inner end with a radial projection forming an engaging element, a cup-shaped housing, having a cylindrical body and an annular cover plate closing one of the ends thereof, the scroll plate being rotatable in the housing with its scroll groove facing the annular cover plate which is formed with radial slots corresponding in number to the slider blocks, a corresponding number of jaws radially movable in the cover plate slots, respectively, and provided at the back with arcuate projections to mesh with the scroll groove, and an operating member axially movable in the bore of the scroll plate and adapted to be moved by actuating means, the operating member being formed at its outer periphery with a corresponding number of engaging means adapted to co-operate with the engaging elements respectively of the slider blocks so as to move them radially when said operating member is moved axially.

The above and other features of the invention are set out in the appended claims and described below with reference, by way of example, to the accompanying drawings, in which:—

Figure 1 is a front elevational view of a chuck embodying the present invention, the cover plate being partly broken away;

Figure 2 is a sectional view of the chuck shown in Fig. 1 taken along the line II–II thereof;

Figure 3 is a sectional view of the chuck shown in Figs. 1 and 2 taken along the line III–III of Fig. 1;

Figure 4 is a front elevational view of the operating member shown in Fig. 1; and

Figure 5 is a sectional view of the operating member shown in Figs. 1 and 4 taken along the line V–V of Fig. 4.

Referring first to Figs. 1 to 3, an annular scroll place 1, having a scroll groove in its front face, has a cylindrical body 22 formed at equi-angular intervals with three radial slots 2 which open to the grooved face. Each of the slots 2 is of rectangular shape in axial view with opposed side walls formed at substantially mid-depth with rectangular-section guide grooves 3 extending mutually parallel with the grooved face.

A slider block 5 having a rectangular shape in axial view and cross section, with ridges 6 to fit the guide grooves 3, is movable radially in each of the slots 2. Further, the face of each slider block 5 has arcuate grooves 4 forming parts of the scroll groove of the scroll plate 1. On the radially inner end of each slider block 5 there is an integral stepped projection 7, of T-shape in axial view A wing piece 8, at the radially innermost end of the projection 7 and constituted by the transverse bar of the T-shape, extends at right angles to the radial direction and is tapered at an angle from the surface having the arcuate grooves 4, so that the surface of the wing piece 8 adjoining the arcuate grooves 4 protrudes further than the surface remote therefrom.

The scroll plate 1 is rotatable in a cup-shaped housing 9, comprising a cylindrical wall 19 and an annular cover plate 10 closing

one of its ends, and the plate 10 facing the scroll groove has three radial slots 11 at equi-angular intervals. Each slot 11 is of rectangular shape in axial view and has opposed guide grooves 12 of rectangular cross-section in opposite walls, at substantially mid-depth.

A jaw 13, of rectangular shape in axial view, is radially movable in each slot 11, and has ridges 14 which are a sliding fit in the guide grooves 12 in the side walls of the slot 11. Each jaw 13 is provided on its back with arcuate projections 15 so as to mesh with the scroll groove of the scroll plate.

A central axial bore 16 is formed through the cylindrical body 22 of the scroll plate 1 and the annular cover plate 10 of the housing 9. Slidable in the bore 16 is a cylindrical operating member 17 which is adapted to be connected to the piston rod 32 of a fluid cylinder (not shown). The outer periphery of the member 17 is formed with three axially extending slots 18, T-shaped as shown in Fig. 4, each slot 18 having a cross-section substantially complementing that of the extremity of the T-shaped projection 7 at the radially inner end of the slider block 5.

The bases of the slots 18, and the opposed parallel surfaces defining the cross parts of these T-slots, slope radially outwardly and rearwardly, to the left as seen in Figs. 3 and 5, so the slots 18 in effect mutually diverge towards the piston rod 32.

The housing 9 has in its cylindrical wall 19 three screw-threaded holes 20, formed from the outside at equi-angular intervals, and at substantially mid-depth each hole 20 has a countersunk reduced diameter end 21 opening at the inner side of the cylindrical wall 19. The cylindrical body 22 of the scroll plate 1 is provided, at positions corresponding to the holes 22, with spherical concave seats 23, each receiving a ball 24 loaded by a coil spring 25, compressed by a setscrew 26 screwed into the respective hole 20.

As shown in Fig. 3, a ring of gear teeth 27 is formed around the radially outer edge of the inner end of the cylindrical body 22 of the scroll plate 1, and a driving pinion 28 is rotatably mounted in the cylindrical body 19 of the housing 9. The pinion 28 has a radially extending conical portion with teeth in mesh with the teeth 27 and adapted to rotate the scroll plate 1.

As shown in Fig. 3, a base plate 29 closes the inner end of the cylindrical wall 19 of the housing 9. A main spindle 30, as of a lathe, has a union member 31 to couple the main spindle 30 to the base plate 29. At the outer end is shown a workpiece 33 clamped by the jaws 13.

The operation of the chuck will be explained below.

When the balls 24, bearing on the cylindrical body 22 of the scroll plate 1 at the concave seats 23, are released by partially unscrewing the setscrews 26 and the pinion 28 is rotated by a suitable tool, in a manner well-known in the art, the scroll plate 1 is rotated relative to the housing 9 through the teeth 27 in mesh with the teeth of pinion 28. Since the arcuate projections 15 on the backs of the jaws 13 are in mesh with the scroll groove of the plate 1, the jaws 13 are moved radially inwardly or outwardly, within the slots 11 in the cover plate 10 of the housing 19, depending on whether the pinion 28 is rotated clockwise or anti-clockwise. A workpiece 33 can thus be suitably clamped by the jaws 13.

The above description if is the explanation of the operation of the chuck when it is used as a simple scroll chuck.

However, operation of the pinion 28 can be stopped at a position in which the jaws 13 nearly clamp the workpiece 33 and the balls 24 are aligned with seats 23. The setscrews 26 are then screwed to compress the coil springs 25 to press the balls 24 into their seats 23, whereby the scroll plate 1 is secured against rotation relatively to the housing 9 and cover plate 10. If the operating member 17 is then pulled leftwards, as viewed in Fig. 3, by the actuation of the fluid cylinder to cause the piston rod 32 to be moved in that direction, the jaws 13 are moved radially inward by the interaction of the T-shaped projections 7, on the slider blocks 5, and the diverging T-shaped slots 18 in the operating member 17. The arcuate grooves 4, in the face of each respective slider block 5, are engaged in alignment with the arcuate ridges 15, in the back of the respective jaw 13, and consequently the jaws are moved radially inwardly as the tapered wing pieces of the projections 7 are drawn radially inwardly by riding up the sloping surfaces of the T-shaped slots 18. Thus, the workpiece 33 is firmly clamped by the jaws 13.

This clamping action of the jaws 13, through the operating member 17, illustrates the chuck provided by the present invention being used as a hydraulic chuck.

From the foregoing it will be appreciated that when the chuck is used as a hydraulic chuck, the jaws 13 being actuated first in a manner of a scroll chuck by rotation of the pinion 28 until the workpiece 33 is nearly clamped by the jaws 13, and subsequently the jaws 13 being moved hydraulically, by means of the operating member 17 and slider blocks 5, to clamp the workpiece 33 firmly, workpieces having close ranges of different diameters can be clamped quickly with the application of quite strong force hydraulically, increasing the productivity of the machine tool, *e.g.* a lathe.

Although a single preferred embodiment of the present invention has been described and illustrated, modifications may be made in the structure, form and relative arrangement of

parts without departing from the scope of the claims.

CLAIMS

1. A machine tool chuck comprising a scroll plate having a cylindrical body with a co-axial bore and a scroll groove in a front face of the body, the cylindrical body having radial slots open to the front face thereof, a corresponding number of slider blocks each radially movable in one of said radial slots and having arcuate grooves forming parts of the scroll groove of the scroll plate, each slider block being provided on its radially inner end with a radial projection forming an engaging element, a cup-shaped housing, having a cylindrical body and an annular cover plate closing one of the ends thereof, the scroll plate being rotatable in the housing with its scroll groove facing the annular cover plate which is formed with radial slots corresponding in number to the slider blocks, a corresponding number of jaws radially movable in the cover plate slots, respectively, and provided at the back with arcuate projections to mesh with the scroll groove, and an operating member axially movable in the bore of the scroll plate and adapted to be moved by actuating means, the operating member being formed at its outer periphery with a corresponding number of engaging means adapted to co-operate with the engaging elements respectively of the slider blocks so as to move them radially when said operating member is moved axially.

2. A machine tool chuck as claimed in claim 1, wherein said radial slots formed in said cylindrical body of said scroll plate and said annular cover plate of said housing are respectively three in number and disposed at equi-angular intervals.

3. A machine tool chuck as claimed in claim 2, wherein said slider blocks and said radial slots of said scroll plate are movably engaged with each other by means of guide grooves and ridges formed therein, respectively.

4. A machine tool chuck as claimed in claim 2, wherein said jaws and said slots of said housing cover plate are movably engaged with each other by means of guide grooves and ridges formed therein, respectively.

5. A machine tool chuck as claimed in claim 1, wherein said projection of each said slider block has generally a T-shape in axial view with said engaging element being constituted by the transverse bar thereof, the radially inner end surface of said projection being tapered such that its front face projects more radially inwards than its rear face, and said engaging means of said operating member has the form of a slot the cross section of which is complementary to said T-shape of said projection.

6. A machine tool chuck as claimed in claim 1, wherein said operating member is adapted to be connected to the piston rod of a fluid cylinder as actuating means.

7. A machine tool chuck as claimed in claim 1, wherein said scroll plate and said cover plate are adapted to be locked at positions where said slots of said scroll plate and said cover plate are in alignment.

8. A machine tool chuck as claimed in claim 6, wherein said scroll plate and said cover plate are locked at each said position by balls each radially movably received within holes formed in said cylindrical body of said housing and constantly spring-loaded towards seats in the outer periphery of said cylindrical body of said scroll plate.

9. A machine tool chuck comprising a rotatable scroll plate and jaws, having projections engaged with the scroll, radially movable inwardly or outwardly by rotation of the scroll plate, the jaws being slidable in radial slots in a cover plate having releasable means to enable the scroll plate to rotate or be secured against rotation relatively to the cover plate, the scroll plate having parts of its scroll formed on radial sliders interengaged through co-acting sloping surfaces with an axially movable operating member so that, with the scroll plate held against relative rotation and the jaw projections engaged with the radial slider parts of the scroll, axial movement of the operating member causes radial movement of the sliders and of the jaws engaged therewith.

10. A machine tool chuck as claimed by claim 9 and substantially as shown by the accompanying drawings.

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